

PREFERRED FORAGING HABITATS OF *JACANA SPINOSA* IN THE PALO VERDE MARSH

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Abstract: Management of marsh habitats can influence avian abundances and distributions through its effects on vegetation structure and food resources. This study documents the foraging sites of Northern jacanas (*Jacana spinosa*) in a tropical marsh undergoing management for invasion of cattail (*Typha domingensis*). We hypothesized that vegetation type influences the foraging behavior of jacanas. We predicted that individuals would spend a greater proportion of their total foraging time and would have a greater number of intraspecific aggressive interactions in habitat dominated by water lilies. Relative to the availability of each vegetation type, jacanas over-utilized water hyacinth and water lily habitats, and under-utilized cattail habitat. Intraspecific aggressive interactions were most frequent in water lily habitat. These results illustrate the importance of several vegetation types, especially water lily and water hyacinth, as foraging habitat of jacanas, and suggest that management control of cattails in this marsh may positively affect the existing quality of food resources for jacanas and perhaps other marsh dwelling species as well.

Key Words: cattails, *Eichhornia crassipes*, hyacinth, intraspecific aggression, *Nymphaea* sp., *Pistia stratiotes*, *Poaceae*, water lettuce, water lilies

INTRODUCTION

The management of threatened aquatic ecosystems often involves the manipulation of vegetation, which in turn may affect the occurrence and abundance of animal residents. The vegetation composition of the Palo Verde marsh, Costa Rica, has recently changed from a diverse community to one dominated by cattails, *Typha domingensis* (Abram et al. 1994), coincidental with a national park management strategy that ended cattle grazing (Gill 1989). Studies suggest that the invasive cattail species found in the marsh negatively affects marsh-dwelling bird species (Mahar et al. 2000) such as the Northern jacana (*Jacana spinosa*), which rely on certain vegetation types for feeding and nesting (Broughton et al. 1994). Specifically, water lilies (*Nymphaea ampla*) are an important foraging substrate for jacanas (Jenni 1983).

We hypothesized that vegetation type influences jacana foraging behavior. We pre-

dicted that more of the total foraging time and the greatest number of aggressive interactions would occur in water lilies. Our analysis of preferred jacana foraging vegetation provides insight to aid future management strategies for maintaining marsh dwelling species.

METHODS

We observed jacanas at three sites along the north edge of the marsh near the OTS field station, Palo Verde National Park, Costa Rica. One site was at the tower lookout, and the other two were near the west end of the old airstrip. The vegetation was categorized by the dominant plant species present: cattail, grasses (*Poaceae*), water hyacinth (*Eichhornia crassipes*), water lilies and water lettuce (*Pistia stratiotes*). At each site we estimated the relative abundance of each vegetation types by visually estimating percent cover within each region of the marsh. These estimates were then averaged across sites to determine the

overall relative abundance of each vegetation type in the total study area.

On 11 January 2000 we observed jacana foraging behavior from 08:00 to 11:30. We randomly choose 45 birds, 15 at each site, and observed each for a period of 3 min. If an individual moved out of sight for more than 30 s, we discontinued the observation. We recorded the bird's behavior (foraging or non-foraging), the duration of each behavior, and the type of vegetation in which the behavior took place. We also recorded the number of intraspecific aggressive interactions and the vegetation type in which they occurred. Aggressive interactions were defined as vocalizations or movement directed at another individual resulting in the displacement of one individual. Following an observation period, we waited 7 min before randomly selecting the next bird.

For each individual, we calculated the time spent foraging and the percent of their total foraging time spent within each vegetation type. We used a Chi-square to test the null hypothesis that birds foraged in different habitats in proportion to the availability of different habitats. For this analysis, observed frequencies for each habitat type were calculated as the product of the proportion of total jacana observations in each habitat type and the total number of birds that we observed ($n = 45$). Thus, observed frequencies corresponded to a hypothetical distribution of 45 birds foraging simultaneously. Expected frequencies for each habitat were calculated based on the proportion of total habitat made up of each habitat type (sum of expected frequencies = 45 jacanas).

We used a one-way ANOVA and the Tukey-Kramer test to compare the proportions of time spent foraging among the five habitats. We used a second Chi-square analysis to test the null hypothesis that aggressive interactions in water lilies vs. grasses occurred in proportion to the time spent foraging in those

habitats.

RESULTS

Jacanas spent more time foraging in some habitats than others (Fig. 1; $F_{4,220} = 33.30$, $p < 0.001$). Jacanas spent 43% of their foraging time in grasses, 26-28% in each of water hyacinth and water lily habitat, and 1 in each of cattail and water lettuce habitat (Fig. 1). The relative abundances of vegetation types within the study area were: grasses (43%), water lily (22%), cattail (21%), water hyacinth (13%), and water lettuce (1%). The percentage of foraging time spent within each vegetation type was not proportional to the availability of vegetation types (Fig. 2; $X^2 = 16.94$, $df = 4$, $p = 0.010$; expected values: cattail = 9.45, grasses = 19.45, water hyacinth = 5.85, water lily = 9.9, water lettuce = 0.45). Thus, water hyacinth and water lily habitats were over-utilized relative to their abundance, and cattail habitat was highly under-utilized (i.e., avoided).

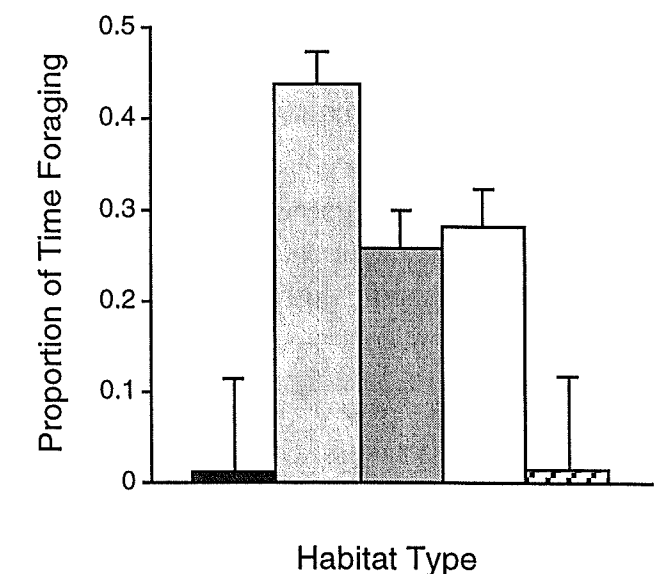


Fig. 1. Proportion of time spent foraging by Northern jacanas in five habitat types at Palo Verde marsh, Costa Rica (C = cattail, G = grasses, WH = water hyacinth, WLil = water lilies, WLet = Water lettuce). Habitats with different letters had significantly different means ($P < 0.05$).

We observed 10 intraspecific interactions during foraging. Nine were in water lilies and one was in grass habitat. Thus, intraspecific aggression was more common per minute of foraging time in water lilies than in grass habitat ($X^2 = 5.94$, $df = 1$, $p = 0.015$, expected values = 4 and 6 for water lily and grass, respectively). We observed no interspecific interactions.

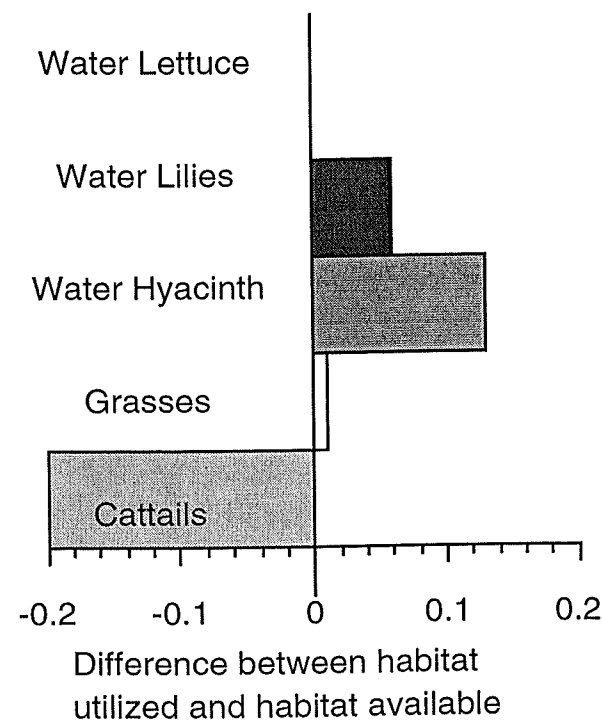


Fig. 1. Differences between the proportion of time foraging in each habitat by Northern jacana and the proportion of habitat types available. Positive values indicate over-utilized habitat; negative values indicate under-utilized habitat. Water lettuce was used almost exactly in proportion to its availability.

DISCUSSION

Jacanas foraged differentially among vegetation types in the Palo Verde marsh. Jacanas spent the highest percentage of their total foraging time in grasses, which was proportional to the relative abundance of grass habitat in the study area. However, water lilies as well as water hyacinth were used in a

much greater frequency than would be expected by the abundances of vegetation type (Fig. 2), indicating that they were the most preferred foraging habitats. This result implies that water lily and water hyacinth might contain more food resources than other habitats, have a structure that is easy for jacanas to move through, and/or have a structure that provides easy accessibility to food. The preference of jacanas for water lilies is further supported by the high number of intraspecific aggressive interactions that occurred in water lily habitat.

The high frequency of foraging in grass habitat by jacanas may be explained in part by the fact that grass was interspersed among more preferred foraging habitats (i.e., water lilies and hyacinth). Thus, jacanas may forage in the highly abundant grasses while en route to water lilies and water hyacinth.

The cattails, which were second highest in relative abundance, were greatly underutilized as foraging habitat. This result strongly suggests that cattails were actively avoided by foraging jacanas. This avoidance may be because the tall, dense patches of cattail afford poor visibility for foraging jacanas and/or because of limited prey availability among the cattails. Jacanas did not usually forage within cattails, but rather tended to walk around them to alternative vegetation types.

A decrease in cattle grazing in the marsh habitat of Palo Verde National Park since 1988 has caused a shift in vegetation composition favoring the invasive cattail (Gill 1989), and thus has reduced jacanas' preferred foraging vegetation. The loss of foraging vegetation could reduce prey capture rates, limit reproductive success, and lower population abundance of jacanas in the long term. Current management efforts that involve the reintroduction of cattle grazing to limit cattail abundance (McCoy and Rodriguez 1994) may be beneficial to jacana populations in the Palo

Verde marsh. A shift away from a cattail-dominated community to a more diverse, water lily- and water hyacinth-dominated community may also benefit other avian species that rely on marsh habitat.

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